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(12) UK Patent Application (19) GB (11) 2 131 067 A

(21) Application No 8329327
(22) Date of filing 3 Nov 1983
(30) Priority data
(31) 8232774
(32) 17 Nov 1982
(31) 8309127
(32) 5 Apr 1983
(33) United Kingdom (GB)
(43) Application published 13 Jun 1984
(51) INT CL³ C09K 7/00
(52) Domestic classification E1F GP PA
(56) Documents cited
EP A 0072445
GB A 2112044
GB 1574797
GB 1495874
GB 1058943
GB 1041069
(58) Field of search E1F

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(54) Improvements in drilling fluids

(57) The addition of minor proportions of a polymer, which is insoluble in water, to oil-based or water-based drilling fluid improves the rheological properties of the fluid and/or improves the fluid loss control of the fluid. Th drilling fluid may be a drilling mud, a workover and completion fluid or other wellbore fluid. Examples of suitable polymers and drilling fluids are described, and the polymer is conveniently added in the form of an aqueous dispersion of the polymer.

SPECIFICATION

Improvements in drilling fluids

This invention relates to drilling fluids.

The term "drilling fluid" as used in this sp cification includes th se fluid compositions which are used in sinking underground bor holes by means of rotary drills, and those compositions which are used in the cours of the locati n, penetration and exploitation of natural gas- and petroleum-b aring earth formations. Such drilling fluids include those known as drilling muds which are used when sinking wells in natural gas and oil fields, as well as those wellbore fluids which are known as completion and workover fluids which are used in the completion of oil wells.

A wide variety of materials are used in compounding drilling fluids to control the properties thereof, so that they are at an optimum for a particular purpose, as described for example under the heading "Petroleum (Drilling Fluids)" in the third edition of Kirk-Othmer "Encyclopedia of Chemical Technology", Volume 17, pages 143 to 167, published 1982 by John Wiley and Son, and in the monograph entitled "Chemicals for oil field operations" edited by J. I. Di Stassis, published 1981 by Noyes Data Corporation.

As indicated above, a drilling fluid comprises a variety of ingredients and it may be classified as being either water-based or oil-based depending upon whether the continuous phase of the fluid is water or oil respectively. Among the most important properties of a drilling fluid which require control by formulation are the rheological characteristics. The instrument known as the Fann Viscometer is in common use for the purpose of arriving at the best formulation possible under laboratory conditions. The readings obtained on the instrument are used to derive the characterising parameters known as plastic viscosity, yield point and gel point value, all data being expressed in so-called Fann units. For less refined screening purposes, the viscosity of the fluid or of the oil on which it is based, may be measured on a Brookfield viscometer, the results being expressed in Pa.s. A wide variety of water-soluble polymeric thickening agents, both non-ionic and anionic, has been proposed for use in controlling the rheological characteristics of water-based drilling fluids. Since water-based drilling fluids are generally alkaline in pH, it is convenient and economical to employ polymeric carboxylic acids as rheology-control agents. In any case the polymer used for rheology control may be naturally-occurring, semi-synthetic or fully-synthetic, and is generally used in combination with inorganic rheology-control agents which are not soluble in water, such as bentonite and other clays. It will also be appreciated that, where one or more other inorganic solids are present in the form of a dispersed powder, such as barytes, they will also exert an effect on the rheological properties of the drilling fluid. Drilling muds commonly contain such inorganic powders in dispersed form in order to increase the density of the mud for example.

Among the other important properties of drilling fluids, which must be controlled by formulation, is that termed fluid loss, that is to say, wastage of the drilling fluid by penetration or leakage of the fluid through the earth formations which constitute the walls of the bore hole. Although special fluid loss agents may form part of the formulation of the drilling fluid, control of fluid loss is dependent to some extent upon the selection of rheology-control agents. In the case of water-based drilling fluids, in particular, the water-soluble polymers used for rheology control exert an effect on the property of fluid loss. There has long existed a need for the ability of the formulator of water-based drilling fluids to improve fluid loss independently of any effect on rheological characteristics.

Accordingly, one aspect of the present invention provides a drilling fluid comprising as one of its ingredients a minor proportion of a water-insoluble polymer present in an amount sufficient to affect the rheological characteristics of the fluid and/or to improve fluid loss control.

The invention also resides in the use of a water-insoluble polymer as an additive for a drilling fluid to affect its rheological characteristics and/or improve fluid loss control.

As stated above, there are two main types of drilling fluids, water-based and oil-based, and the aforesaid water-insoluble polymer, which can be a synthetic polymer or a natural rubber latex, can be included as an ingredient in either of such fluid types.

The polymer will usually and preferably be available in the form of an aqueous dispersion and the polymer may be incorporated in a drilling fluid as one of its ingredients by adding a minor amount of the aqueous dispersion to the drilling fluid, as this is the simplest and most convenient way of incorporating the polymer in the drilling fluid. In a water-based drilling fluid, the polymer will become dispersed throughout the fluid but when the polymer is incorporated in an oil-based drilling fluid it may either be dispersed in the fluid or, as discussed below, become dissolved in the oil.

Aqueous dispersions of the polymers are particularly useful in oil-based drilling fluids which in any case incorporate a small amount of water as a dispersed phase, and preferred polymers are natural rubber latex and those synthetic polymers which are mainly soluble in hydrocarbon oils or which are oil-swellable. The polymers may incorporate polymerised or copolymerised units derived from unsaturated monomers with pendant oleophilic groups which render the polymers oil-soluble, such as higher alkyl (meth)acrylates, for example, lauryl methacrylate, but those polymers are preferred which are hydrocarbons or comprise a major proportion of copolymerised hydrocarbon. It is preferred to use hydrocarbon polymers and these may be homopolymers or copolym rs. Examples of suitable

homopolymers include polybutadiene, polyisoprene, polyisobutylene and natural rubber latex, which may be vulcanised or pr vulcanised, while examples of suitable copolymers include ethylene/propylene copolymers and butadiene/styrene copolymers especially those which contain 50 to 95% by weight of copolym rised butadiene and 50 to 5% by weight of copolymerised styrene.

As just indicated, preferred polymers for use in oil-based drilling fluids are 100% hydrocarbon polymers, but polymers which contain minor proportions of other copolymerisable monomers, such as copolymerisable acids, such as acrylic, methacrylic, itaconic or fumaric acids, or amides such as acrylamide, or copolymerisable non-hydrocarbon monomers such as acrylate or methacrylate esters or acrylonitrile can also be used. However, the hydrocarbon monomer(s) would normally be 70 to 100% by weight of the total weight of the polymers, more preferably 95 to 100% by weight of the total weight of the polymer.

Polymers which are non cross-linked and have a low gel content will dissolve in the oil, or swell highly and this will have an influence on the rheological properties imparted by the polymers to the drilling fluid as well as reducing the fluid loss. The gel content and degree of cross-linking are factors which have to be taken into account in assessing the suitability of any particular polymer for use in any particular drilling fluid in any particular location. However, these factors will, in general, be assessed on an empirical basis.

The polymer itself is preferably used in the form of an aqueous dispersion and such dispersions may be prepared by a variety of conventional procedures. If the polymer is obtained in the form of a fine-particled dispersion, it may be desirable to subject the dispersion to a conventional agglomerating procedure as, in general, coarse-particled emulsions are preferred to fine-particled emulsions. The particle size of the emulsion is another factor which will be taken into account on an empirical basis when formulating a drilling fluid for a particular use. If the polymer is available in the form of a dry powder, it may be converted into a dispersion either using water or a part or all of the drilling fluid.

To use the polymer dispersion in an oil-based drilling fluid, it is necessary to disperse it in the oil, and for this purpose an emulsifier is necessary. Polymer dispersions will normally contain an emulsifier added for the preparation of the polymers or subsequently to stabilise them, and the drilling fluid will also normally contain a surfactant but it is normally necessary to add additional oil-soluble surfactant to disperse the polymer dispersion in the oil or oil-based fluid. The emulsifier may be added to the polymer dispersion, or to the oil, or to both. It is possible to use anionic, cationic or non-ionic emulsifiers, such as sodium di(higher alkyl)sulphosuccinates, fatty amine/amide emulsifiers and alkyl phenol alkylene oxide condensates.

It is known to use water-soluble polymers as thickeners for water-based drilling fluids which are generally of a basic nature, but we have now discovered that the aforesaid aqueous dispersions of water-insoluble polymers are useful for fluid loss control in aqueous systems and give better fluid loss control for aqueous systems than do water-soluble polymers. These polymer dispersions may be of similar types to the mainly hydrocarbon polymers described above especially those which contain minor proportions of other copolymerisable monomers such as copolymerisable acids, but for water-based drilling fluids it is also possible to use other polymers such as polyvinyl acetate and its copolymers, and polymers and copolymers of acrylic and methacrylic esters. Polymers for use with water based drilling fluids may have a certain degree of swellability in water while remaining water-insoluble.

Some drilling fluids, especially drilling muds are made up in salt water. Some polymer dispersions are stable to salt water and give the same results in either fresh or salt water. Other polymer dispersions are flocculated to a greater or lesser extent. Some degree of flocculation may be desirable and give a reduction in fluid loss, but excessive flocculation is undesirable and reduces the fluid loss control, and these polymer dispersions need extra stabilization.

It will be appreciated that a wide range of control over the rheological properties and or fluid loss can be achieved by appropriate choice of polymer and polymer dispersions.

The amount of polymer added to the drilling fluid is a minor proportion of the amount of the fluid and will depend to a great extent on the nature of the polymer and the constitution of the drilling fluid and the degree of control over the rheological properties and/or fluid loss that is required. In general, the amount of polymer may vary from 0.1 to 200, preferably 0.5 to 150, parts by weight of polymer (dry basis) per 1000 parts by weight of drilling fluid. In the case of drilling muds, which usually contain other viscosity control agents such as clays, bentonite and barytes, an amount of polymer of from 1 to 15 parts by weight, more preferably 3 to 6 parts by weight, per 1000 parts by weight of drilling mud is usually required. However, for other drilling fluids, such as workover and completion fluids which may consist almost entirely of oil up to 10 times the amount of polymer, but preferably from 20 to 60 parts by weight per 1000 parts by weight of drilling fluid, may be required.

In view of the minor amount of polymer required to effect control over the rh ol gical properti s and/ r fluid loss, the concentration of the polymer in the dispersion is of little cons quence and the dispersion will be presented in a concentration most convenient for use and for transport. Conv niently, the concentration will usually be from 40 to 60% by weight but c ncentrations outside this range can be usefully employed.

based drilling fluids such that when 3% by dry weight of polymer dispersion is added to the oil the viscosity, as measured on the Brookfield Viscometer, is increased at least threefold and/or the fluid loss is reduced at least tenfold as compared with the plain oil.

A similar tenfold reduction in the fluid loss as compared with plain water is preferably also achieved for water-based drilling fluids by appropriate choice of polymer.

Drilling fluids, especially drilling muds, always contain a range of additives to control the properties as indicated above and the aforesaid polymer dispersions would, in practice, be used with inorganic and other additives to control the properties of th mud, such as barytes to increase the density, and optionally bentonite or other clays for additional rheology control and other additives as known to the prior art. However the present aqueous dispersions may replace bentonite or other clays wholly or in part.

The invention will now be illustrated by the following Examples.

Test methods

In the following Examples mixtures of the ingredients listed were prepared on a laboratory stirrer. All mixtures are given in parts by weight. The mixtures were tested using various test methods as indicated below.

Test Method 1

The viscosity of the mixture was measured on a Brookfield LVT viscometer at 6 and 60 rpm unless otherwise stated.

Test Method 2

This measured the fluid loss control of the mixture by filtering the mixture under vacuum on a Buchner funnel using a "Whatman" 542 filter paper of 6 cm diameter. This has a similar porosity to the "Whatman" 50 paper used in the API test. For some mixtures giving very low fluid loss the more porous "Whatman" No. 1 filter paper was also used. ("Whatman" is a registered Trade Mark). The fluid loss was measured either by the time taken for 20 ml of fluid to come through if this was less than 15 minutes, or by the amount that had come through in 15 minutes if this was less than 20 ml.

Test Method 3

This was used for water-based systems to measure the fluid loss control by filtering, under the above conditions set out in Test Method 2, the polymer dispersion diluted to 5% polymer content with either water, or 3% sodium chloride, or saturated sodium chloride. Under these conditions the viscosity of the polymer dispersion was essentially the same as that of water.

Example No. 1

Oil	100
"Aerosol" OT	2.5
PD1	3

The oil is diesel fuel, viscosity at 6 and 60 rpm at 6 cp, of the kind conventionally used in making oil-based drilling muds,

"Aerosol" OT is 60% sodium dioctyl sulphosuccinate,

PD1=Polymer dispersion No. 1, is an aqueous dispersion of a copolymer of approximately 70 parts butadiene to 30 parts of styrene by weight and approximately 50% solids content. The gel content of the copolymer is approximately 25%. The weight given in the formula above is the wet weight of the polymer dispersion.

The Brookfield viscosity at 6 rpm was 32 centipoises, and at 60 rpm was 22 cp.

Fluid loss in 15 minutes. Nil on 542 paper; 1 ml on No. 1 paper.

Example No. 2

Oil	100
"Aerosol" OT	2.5
PD1	6

Viscosity at 6 rpm was 140 cp, and at 60 rpm was 108 cp.

Fluid loss Nil on 542 paper; Nil on No. 1 paper.

Example No. 3

Oil	100
"Aerosol" OT	2.5
PD1	10

Viscosity at 6 rpm was 1210 cp, and at 30 rpm was 780 cp.

Fluid loss Nil on 542 paper; Nil on No. 1 paper.

Example No. 4

Oil	100
"Aerosol" OT	5
PD1	6

Viscosity at 6 rpm was 152 cp, and at 60 rpm was 125 cp.
Fluid loss Nil on 542 paper; half ml on No. 1 paper.

Example No. 5

Oil	100
"Arkopal" N-040	3
PD1	6

"Arkopal" N-040 is an alkyl phenol ethylene oxide condensate non-ionic surfactant.
Viscosity at 6 rpm was 225 cp, and at 60 rpm was 180 cp.
Fluid loss Nil on 542 paper; half ml on No. 1 paper.

Example No. 6

Oil	100
"Chemvert" PE	3
PD1	6

"Chemvert" PE is a fatty amine/amide cationic surfactant Viscosity at 6 rpm was 160 cp, and at 60 rpm was 80 cp Fluid loss Nil on 542 paper; 1 ml on No. 1 paper.

Example No. 7

Oil	100
"Aerosol" OT	2.5
Water	5

This is a control to show the effect of just the surfactant and water on the viscosity, without the addition of the polymer dispersion.
Viscosity at 6 rpm was 20 cp, and at 60 rpm was 8 cp.
Fluid loss 20 ml in 1 minute 20 seconds.
The fluid loss of the plain oil, without water or surfactant, was 20 ml in 25 seconds.

Example No. 8

Oil	100
"Aerosol" OT	2.5
PD2	5

PD2 is 60% natural rubber latex.
Viscosity at 6 rpm was 375 cp, and at 60 rpm was 365 cp.
Fluid loss Nil on 542 paper; 11 ml on No. 1 paper.

Example No. 9

Oil	100
"Aerosol" OT	2.5
PD3	5

PD3 is a prevulcanized natural rubber latex of 60% solids content.
Viscosity at 6 rpm was 23 cp, and at 60 rpm was 12 cp.
Fluid loss 5.5 ml.

Example No. 10

Oil	100
"Arkopol" N-040	4
PD4	5

PD4 is an aqueous polyisobutylene dispersion, approximately 50% solids content.
Viscosity at 6 rpm was 215 cp.

Example No. 11

Oil	100
"Aerosol" OT	2.5

PD5 is an approximately 50% by weight solids aqueous dispersion of a copolymer of approximately 70 parts of butadiene and 30 parts of styrene and of approximately 70% gel content.

Viscosity at 6 rpm was 16 cp and at 60 rpm was 12 cp.

Fluid loss 7 ml.

Example No. 12

Oil	100
"Arkopal" N-040	3
PD6	5

PD6 is an aqueous dispersion of a copolymer of butadiene and styrene, containing approximately 60% of butadiene and 2.5% itaconic acid and of approximately 50% solids content.

Viscosity at 6 rpm was 15 cp, and at 60 rpm was 11 cp.

Fluid loss 20 ml in 3 min 50 seconds.

Examples of fluid loss control on aqueous based systems are as follows:—

	Water		*3% NaCl*	
	Time for 20 ml	*ml in 15 min*	*Time for 20 ml*	*ml in 15 min*
No additive	9 sec		9 sec	
PD1		6	15 sec**	
PD2		19		14*
PD3		15		10*
PD5	30 sec		6 mins 25 secs*	
PD6		11		11
PD7		18		18
PD8		6		4*
PD9		0.5		0.5
PD6			Saturated NaCl	12

* slight flocculation

**severe flocculation.

PD7 is an aqueous dispersion of a copolymer of butadiene and styrene containing approximately 40% butadiene and 1% acrylic acid and of approximately 50% solids content.

PD8 is an aqueous dispersion of a polyvinyl acetate homopolymer of approximately 50% solids content.

PD9 is an aqueous dispersion of a copolymer of approximately 55 parts of 2-ethyl hexyl acrylate and 45 parts of vinyl acetate and of approximately 50% solids content.

The following Examples describe the use of the aforesaid aqueous dispersions of water-insoluble polymers in actual drilling mud formulations.

The following Examples, equivalent values are given for temperatures in °C, and for pressures in kg/cm². However, as is conventional in the oil industry and as well understood by those skilled in the art the proportions for the compositions of the drilling muds are based on barrels (bbl) (a barrel of water weighs 350 lb=158.7 Kg) and pounds per barrel (ppb).

In the following Examples, each formulation gives an amount of 1 barrel.

Example No. 13

Polymer dispersion PD1 in an invert mud at 75/25 oil/water ratio and 650 psi/1000 ft (45.7 kg/cm²/304.8 m)

An invert emulsion oil mud was formulated as follows:—

0.566	bbl	Diesel oil
6	ppb	"Emul" [1]
2	ppb	"Emul FL" [2]
5	ppb	Lime
2	ppb	"Emul Vis" [3]
32.9	ppb	Calcium chloride (96/98%)
0.188	bbl	Water
241	ppb	Barytes.

Notes

[1] Primary emulsifier commercially available from B. W. Mud Ltd.

[2] Secondary emulsifier commercially available from B. W. Mud Ltd.

[3] Viscosifier commercially available from B. W. Mud Ltd.

To this base oil mud were added varying concentrations of PD1 and the properties determined. The results are given in th following table:

Conc ntration of PD1 (ppb)

Properties	*0*	*2*	*4*	*6*
Fann viscometer				
dial reading at 600 rpm	44	73	106	160
dial reading at 300 rpm	23	43	64	97
Plastic viscosity	21	30	42	63
Yield point	2	13	22	34
Gel point value	4/5	8/11	10/14	13/16
Fluid loss HTHP*	6.6	2.0	1.6	1.4
Emulsion stability volts	540	820	840	850

These are given in "Fann units" derived from the readings on a Fann Viscometer.

High temperature and pressure at 200°F and 500 psi differential pressure (93.3°C and 35.15 kg/cm²).

All viscosities were measured at 120°F (48.8°C).

Example 14

PD1 in an invert mud at 90/10 oil/water ratio and 550 psi/1000 ft (38.66 kg/cm²/304.8 m)

An invert emulsion oil mud was formulated as follows:—

0.744	bbl	Diesel oil
4	ppb	"Emul"
2	ppb	"Emul FL"
5	ppb	Lime
5	ppb	"Emul Vis"
9.6	ppb	Calcium chloride (96/98%)
0.083	bbl	Water
165	ppb	Barytes

To this base were added varying concentrations of PD1 and the properties determined. The results are given in the following table:

Concentration of PD1 (ppb)

Properties	*0*	*4*	*7*	*10*
Fann viscometer				
dial reading at 600 rpm	33	67	103	187
dial reading at 300 rpm	17	39	65	118
Plastic viscosity	16	28	38	69
Yield point	1	10	27	49
Gel point value	5/6	7/9	10/13	18/20
Fluid loss HTHP*	9.2	2.8	2.6	2.0
Emulsion stability volts	1240	2000+	2000+	2000+

Exampl 15

PD1 in a low toxi ity invert mud at 80/20 oil/water ratio and 546 psi/1000 ft (38.38 kg/cm²/304.8 m)

An invert emulsion oil mud was formulated in a low toxicity base oil as follows:—

0.631	bbl	Base oil ("Energol" HPO): obtained from BP
7	ppb	"Kleemul" [1]
2	ppb	"Kleemul" S[2]
6	ppb	PD1
6	ppb	Lime
5	ppb	"Kleemul" Vis[3]
0.159	ppb	Water
24.7	ppb	Calcium chloride (96/98%)
148	ppb	Barytes

[1] Primary emulsifier commercially available from B. W. Mud Ltd.
[2] Surfactant commercially available from B. W. Mud Ltd.
[3] Viscosifier commercially available from B. W. Mud Ltd.

The properties of the mud were determined before and after hot-rolling at 250°F (121°C) for 16 hours.

Properties	*Before hot-roll*	*After hot-roll*
Fann viscometer		
dial reading at 600 rpm	75	100
dial reading at 300 rpm	46	65
Plastic viscosity	29	35
Yield point	17	30
Gel point value	6/9	7/10
Fluid loss HTHP*	1.4	1.2
Emulsion stability volts	600	560

Example 16

Polymer dispersion PD6 in an invert mud at 75/25 oil/water ratio and 650 psi/1000 ft (45.7 kg/cm²/304.8 m)

An invert emulsion oil mud was formulated as follows:—

0.566	bbl	Diesel oil
6	ppb	"Emul"
2	ppb	"Emul FL"
5	ppb	Lime
4	ppb	"Emul Vis"
32.9	ppb	Calcium chloride (96/98%)
0.188	bbl	Water
241	ppb	Barytes

To this base were added varying concentrations of PD6 and the properties determined. The results are given in the following table:

Concentration of PD6 (ppb)

Properties	*0 typical*	*2*	*4*	*6*
Fann viscometer				
dial reading at 600 rpm	71	75	81	93
dial reading at 300 rpm	46	48	51	59
Plastic viscosity	25	27	30	34
Yield point	21	21	21	25
Gel point value	11/14	11/15	12/15	13/16
Fluid loss HTHP*	5.6	1.8	1.6	1.2
Emulsion stability volts	800	980	1200	1260

Exampl 17

PD6 in a 90/10 oil/water ratio invert oil mud at 500 psi/1000 ft (38.66 kg/cm²/30.48 m)

An invert emulsion oil mud was formulated as follows:—

0.819	bbl	Diesel oil
4	ppb	"Emul"
2	ppb	"Emul FL"
6	ppb	PD6
5	ppb	Lime
6	ppb	"Emul Vis"
0.091	bbl	Water
15.6	ppb	Calcium chloride (96/98%)
134	ppb	Barytes

The properties were recorded before and after hot-rolling at 250°F (121°C) for 16 hours.

Properties	*Before hot-rolling*	*After hot-rolling*
Fann viscometer		
Dial reading at 600 rpm	29	46
Dial reading at 300 rpm	17	28
Plastic viscosity	12	18
Yield point	5	10
Gel point value	2/3	4/6
Fluid loss HTHP	4.4	3.6
Emulsion stability volts	796	1040

Claims

1. A drilling fluid comprising as one of its ingredients a minor proportion of a water-insoluble polymer in an amount sufficient to affect the rheological properties of the fluid and/or to improve fluid loss control.

2. A drilling fluid as claimed in Claim 1, wherein the fluid is oil-based.

3. A drilling fluid as claimed in Claim 1, wherein the fluid is water-based.

4. A drilling fluid as claimed in Claim 1, 2 or 3, wherein the polymer is soluble or swellable in a hydrocarbon oil.

5. A drilling fluid as claimed in any one of Claims 2 or 4, wherein the polymer is dispersed or dissolved in the oil-based fluid.

6. A drilling fluid as claimed in Claim 3, wherein the polymer is dispersed in the water-based fluid.

7. A drilling fluid as claimed in any one of Claims 1 to 6, wherein the polymer is in the form of an aqueous dispersion prior to its incorporation in the drilling fluid.

8. A drilling fluid as claimed in Claims 2 and 7, wherein the drilling fluid comprises a hydrocarbon oil, said aqueous dispersion and an emulsifier for said dispersion.

9. A drilling fluid as claimed in Claims 2 and 7, wherein the drilling fluid is a drilling mud comprising a hydrocarbon oil, said aqueous dispersion, an emulsifier for said dispersion and one or more inorganic density-increasing and/or rheology-controlling additives.

10. A drilling fluid as claimed in any one of Claims 1 to 9, wherein the polymer is a synthetic hydrocarbon homopolymer or copolymer, or natural rubber latex.

11. A drilling fluid as claimed in Claim 10, wherein the polymer is selected from polybutadiene, polyisoprene, polyisobutylene, unvulcanized rubber latex, prevulcanized rubber latex, ethylene/propylene copolymers and butadiene/styrene copolymers.

12. A drilling fluid as claimed in Claim 11, wherein the polymer comprises from 50 to 95% by weight of copolymerised butadiene and from 50 to 5% by weight of copolymerised styrene.

13. A drilling fluid as claimed in Claim 1, 2 or 3, wherein the polymer is a copolymer comprising at least 70% by weight of copolymerised hydrocarbon monomer(s) and one or more other copolymerisable monomers.

14. A drilling fluid as claimed in Claim 13, wherein the other copolymerisable monomer is selected from copolymerisable acids, amides, acrylate esters, methacrylate esters and acrylonitrile.

15. A drilling fluid as claimed in Claim 13 or 14, wherein the polymer comprises at least 95% by weight of hydrocarbon monom r(s).

16. A drilling fluid as claimed in Claim 3, wh rein th polymer is s lected from hom polymers and copolymers of vinyl acetate and homop lymers and copolymers of acrylic and methacrylic esters.

17. A drilling fluid as claimed in any one of Claims 1 to 16, wherein the drilling fluid contains from

18. A drilling fluid as claimed in any one of Claims 1 to 17, wherein the drilling fluid contains from 0.5 to 150 parts by weight of polymer per 1000 parts by weight of drilling fluid.

19. A drilling fluid as claimed in any one of Claims 1 to 18, wherein the drilling fluid is oil-based and contains from 1 to 20 parts by weight of polymer per 1000 parts by weight of drilling fluid.

20. A drilling fluid as claimed in any one of Claims 1 to 18, wherein the drilling fluid is water-based and contains from 20 to 60 parts by weight of polymer per 1000 parts by weight of drilling fluid.

21. A drilling fluid in accordance with Claim 1 substantially as hereinbefore described in any one of Examples 1 to 6 and 8 to 17 of the foregoing Examples.

22. The use of a water-insoluble polymer to improve the rheological properties of and/or fluid loss control in an oil-based or water-based drilling fluid.

23. The use of an aqueous dispersion of a polymer which is insoluble in water to improve the rheological properties of and/or to improve fluid loss control in an oil-based or water-based drilling fluid.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1984. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.